Axial piston compressor, especially a compressor for the air-conditioning system of a motor vehicle

Claims

1. Axial piston compressor, especially a compressor for the air-conditioning system of a motor vehicle, having a housing and, for drawing in and compressing a coolant, a compressor unit arranged in the housing and driven by means of a drive shaft (104), the compressor unit comprising pistons moving axially back and forth in a cylinder block and comprising a swash plate (107) which drives the pistons and rotates together with the drive shaft (104), characterised in that
for a predetermined mass of the swash plate (107) moved in rotation on the one hand and/or a particular mass moved in translation (for example, pistons, piston rod and/or sliding blocks) on the other hand, the mean radius governed by the geometry and/or by the density distribution and/or the mean height of the swash plate (107) or of the pivotal portion thereof is/are so selected that the centrifugal forces occurring on rotation of the swash plate (107) are sufficient to counteract the pivotal movement of the swash plate (107) to provide deliberate regulation and thereby to influence, especially to reduce or to limit, the piston stroke and, consequently, the quantity delivered.

2. Axial piston compressor according to claim 1, characterised in that
the swash plate is a swash ring (107).

3. Axial piston compressor according to claim 1 or 2, characterised in that
the quotient moment of inertia/mass "J/m" of the swash plate (107) or of the pivotal part thereof is at least about 250 gmm^2/g, especially greater than 400 to 500 gmm^2/g, higher values being selected when the piston masses are greater than 40 g/piston, and the moment of inertia "J" being calculated in relation to each axis through the centre of gravity of the swash plate or of the pivotal part thereof.

4. Axial piston compressor according to claim 3,

characterised in that
the swash plate or the pivotal part thereof is made from a material having a density of at least 6 - 8 g/cm^3.

5. Axial piston compressor according to one of claims 1 - 4, characterised in that
the swash plate (107) or the pivotal part thereof is made from two or more disparate materials governing the mean radius for the calculation of the mass moment of inertia, the disparate materials being separated from one another radially and/or axially, especially so that in the case of a swash ring (107) an outer (107a) or inner partial ring is made from a first material (107i), for example a material of relatively high density, such as lead or the like, inside an outer (113) or inner circumferential groove of an inner (107i) or outer partial ring, which is made from relatively hard and wear-resistant material such as, for example, steel, ceramic material or the like.

6. Axial piston compressor according to one of claims 1 - 5, characterised in that
the swash plate (107) or the pivotal part thereof has, in relation to each centre of gravity axis, a mass moment of inertia "J" greater than 100,000 g/mm^2, especially greater than 200,000 to 250,000 g/mm^2.

7. Axial piston compressor according to one of claims 1 - 6, characterised in that
the pistons each have a mass of about 30 g to 90 g, especially 35 g to 50 g.

8. Axial piston compressor according to one of claims 1 - 7, characterised in that
the mean radius and/or the mean height of the swash plate or of the pivotal part thereof is/are so dimensioned that the centrifugal forces occurring on rotation of the swash plate (107), which forces counteract the pivotal movement of the swash plate (107), are greater than the forces acting on the swash plate from the pistons, which forces cause further extending pivotal movement, so that with increasing speed of rotation the piston stroke is reduced by an amount such that an approximately constant delivered quantity is established.

9. Axial piston compressor according to one of claims 1 - 8,

characterised in that
the centre of gravity of the swash plate (107) or of the pivotal part thereof is located in or at least close to the axis of the drive shaft (104), where especially also the centre of the tilt-providing articulation is located.

10. Axial piston compressor according to one of claims 5 - 9,
characterised in that,
when the swash plate (107) or the pivotal part thereof is made from a plurality of materials of different densities, the radially outer parts (107a) consist of denser material than the radially inner parts (107i).

11. Axial piston compressor according to one of claims 2 - 10,
characterised in that,
when the swash plate is in the form of a swash ring (107), the inner and outer diameters are each selected maximally within the external conditions (for example, inner diameter of the drive mechanism space, sufficient support for the sliding blocks of an articulated arrangement effective between the pistons and swash plate, etc.).

12. Axial piston compressor according to one of claims 5 - 11,
characterised in that,
when the swash plate is made from at least two materials of different densities, one material has a density of 6 - 8 g/cm^3, whereas the other material has a density greater than 6 - 8 g/cm^3.

13. Axial piston compressor according to one of claims 1 - 12,
characterised in that
the quotient $M_{sw}/M_{k,ges}$ is ≥ 1, M_{sw} being the moment due to the moment of deviation of the swash plate and $M_{k,ges}$ being the moment due to the mass forces of the masses moved in translation (pistons).

14. Axial piston compressor according to one of claims 1 - 13,
characterised in that
the quotient of the mass inertia of the swash plate in relation to the y axis, that is to say an axis perpendicular to the z or drive shaft axis, and the total piston mass "$J_y/m_{k,ges}$" is at least about 250 - 300 g mm^2/g for the case where

$m_{sw}/m_{k,ges} = 1$, wherein:

m_{sw} = mass of the swash plate (= rotating mass)

$m_{k,ges}$ = mass of all pistons, including sliding blocks (= translational mass).

15. Axial piston compressor according to one of claims 2 - 14, characterised in that the distance "R" between the piston axis and drive shaft axis results from the relation

$$R = (r_a + r_i)/2$$

wherein

r_a = outer radius of the swash ring (107), and

r_i = inner radius of the swash ring (107).